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THE FIRST FAUNA OF THE EARTH.

BY JOSEPH F. JAMES.

(*Continued from page 887*).

In 1886, there came an announcement from Sweden that was received with incredulity upon this side of the Atlantic. The geologists there had determined that instead of the *Olenellus* fauna occupying the middle position, it was at the base, and the *Paradoxides* fauna was in the middle. Continuous sections showed the rocks of Lower, Middle and Upper Cambrian age in conformable succession, and the question at once arose, Could there be one sequence upon the eastern and a different one on the western side of the Atlantic? If not, then which was correct? The difficulty on this side was to find a continuous section, and it was not until 1888 that it was found. In that year, Mr. C. D. Walcott, now the Director of the U. S. Geological Survey, found in Newfoundland the desired section.[1] Here the *Olenellus* fauna was at the base, and the *Paradoxides* fauna was above it.

The base of the Cambrian being thus at last defined, it then remained to ascertain the extent and variety of organic life in these old rocks. To Mr. Walcott again the world owes the best exposition of this fauna. In a paper published in 1890, he showed there was a variety and profusion of life that had never before been imagined. In this fauna there were representatives of all the great classes of invertebrates. Strange to say, the most highly organized class had the greatest number of species, as shown below:

Spongiæ	4 species.
Hydrozoa	2 species.
Actinozoa	9 species.
Echinodermata	1 species.
Annelida (?)	6 species.
Brachiopoda	29 species.
Lamellibranchiata	3 species.

Gastropoda	13 species.
Pteropoda	15 species.
Crustacea	8 species.
Trilobita	51 species.

The astonishing number of 141 American species was therefore known in 1890 from this very old series of rocks, and this has since been added to until there are now known from the world nearly 200 species, distributed among about 75 genera. The illustrations accompanying this article show some members of most of the classes above-mentioned. In Figure 4 is shown the cup of a small specimen of *Archæocyathus profundus*, one of the Actinozoa. In Figure 5 we have two views of *Medusites lindstromii*, one of the Hydrozoa, and supposed to represent casts of the gastric cavity of a jelly-fish. In Figure 6 there are shown a number of forms of Brachiopoda, a class which, in times past, was very abundant, but which now has only a limited number of representatives. Figure 7 shows some species of Gastropods and Figure 8 the three known species of Lamellibranchiata or bivalve shells which are, to-day, so abundant in the fresh and salt waters of the globe. In Figure 9 there is

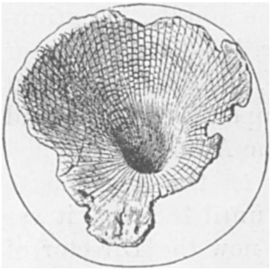

Fig. 4. *Archæocyathus profundus.*

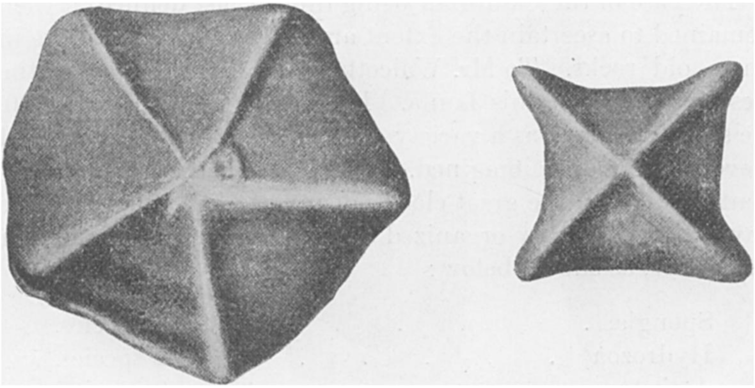

Fig. 5. *Medusites lindstromii.*

shown one of the species of annelids. The soft bodies of these animals have, of course, decayed, and all that remains to tell of their former existence is a vast variety of trails and burrows, which, in some places, cover the rocks in myriads. The problematic character of fossils has caused them to be described as Algæ, but there seems no reason to doubt that they were really worm casts, burrows or trails. In Figure 10 are shown some species of Hyolithes, a genus of *Pteropods* now entirely extinct, but represented in the Lower Cambrian by eight species and one variety. Figure 11 is a representation of a

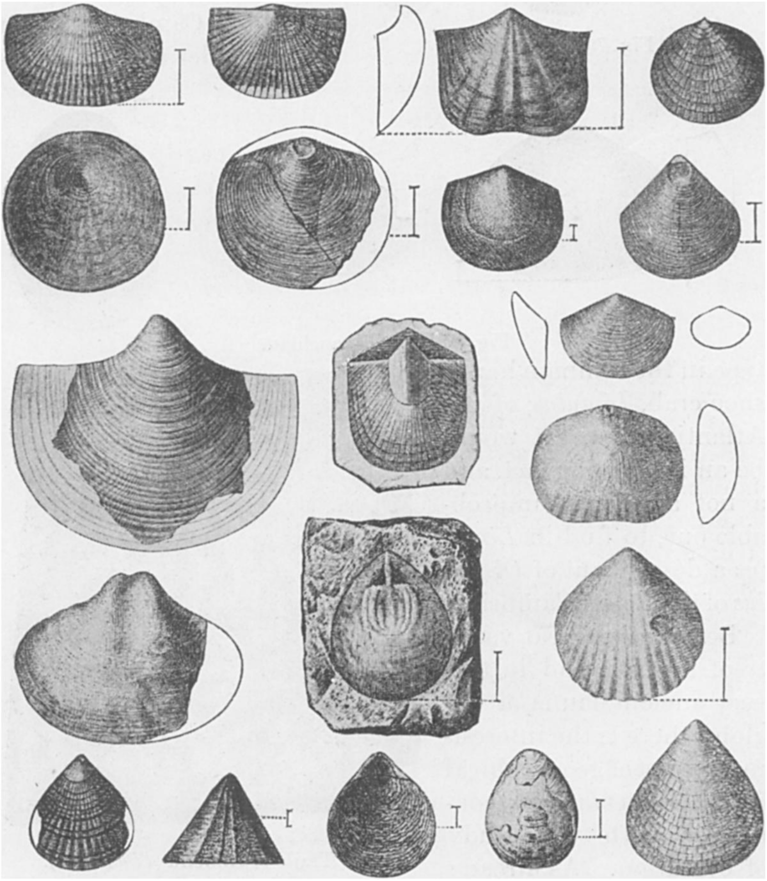

Fig. 6. Various species of Brachiopoda.

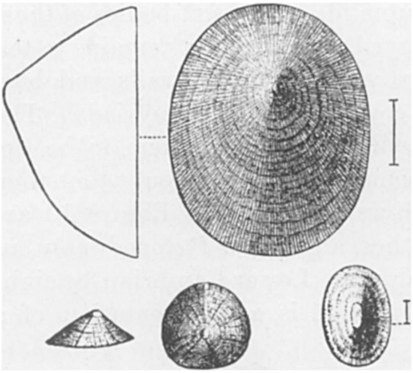

Fig. 7. Gastropoda.

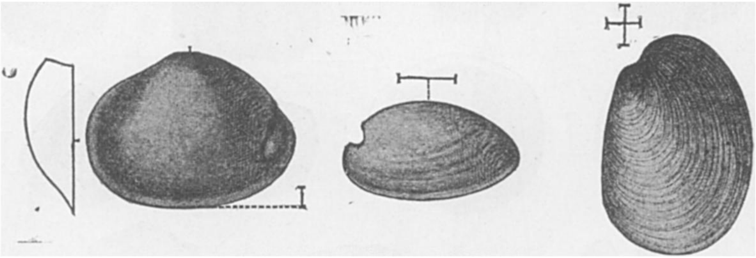

Fig. 8. Lamellibranchiata.

crustacean in a nearly perfect state of preservation, and Figure 12 is a group of trilobites of various genera, most of them belonging to the typical genus of the Lower Cambrian, *Olenellus*. This genus, as pointed out by Walcott, is probably genetically related to *Paradoxides*, the typical genus of trilobites of the Middle Cambrian, and it has its modern, living prototype in the common horseshoe crab, *Limulus*, of the Atlantic coast. It would be an interesting fact, and a not altogether improbable one, to find in *Limulus* a descendant of *Olenellus* of the Lower Cambrian.

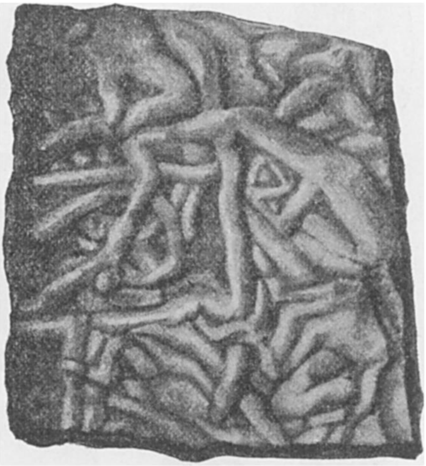

Fig. 9. Trails of Annelids (*Planolites*).

Besides the great variety of forms found in this very ancient fauna of the globe, there is the interesting subject of geographical distribution and its connection with the study of evolution. As already stated, the three great divisions of the Cambrian, the Lower, Middle and Upper, are each characterized by a special genus of trilobite. In the lower zone we have *Olenellus*, in the middle zone *Paradoxides*, and in the upper zone *Dikellocephalus*. These three genera are so closely related that it does not require any stretch of the imagination to regard one as a descendant of the previously existing form. It is true there are no exactly connecting links between the three, and yet there are genera known which have certain intermediate characters. In some localities the three zones present an almost conformable sequence, with scarcely a break in sedimentation, but in other places there is a very perceptible time interval between them. In the former cases, the intermediate genera are known to occur.

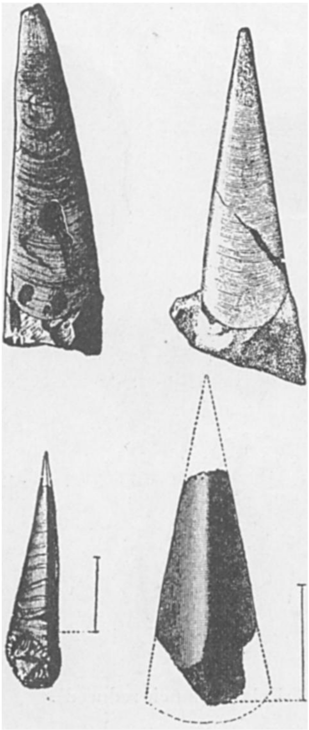

Fig. 10. Pteropoda (*Hyolithes*).

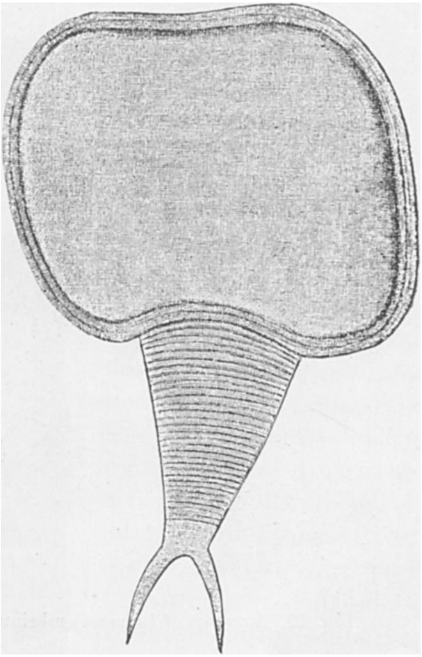

Fig. 11. *Protocaris marshii.*

We have already seen that the fossils of the Lower Cambrian are found in New York, Vermont, New Brunswick, Newfoundland, Sweden, Wales and Bohemia. But they have likewise been collected in Massachusetts, Georgia, Alabama and Tennessee on the Atlantic side of North America, and from British America, Utah, Nevada and California on the Pacific side. They have also been found in France, in Sardinia, and in Russia, while fossils of the immediately succeeding middle and upper zones occur in all these places and in India, China, Australia and South America. It would thus appear that at a very early period in the history of the earth, the faunas then living had an almost world-wide distribution. There is, however, little to be wondered at in this, since it is probable that the conditions of existence at that early day were very uniform.

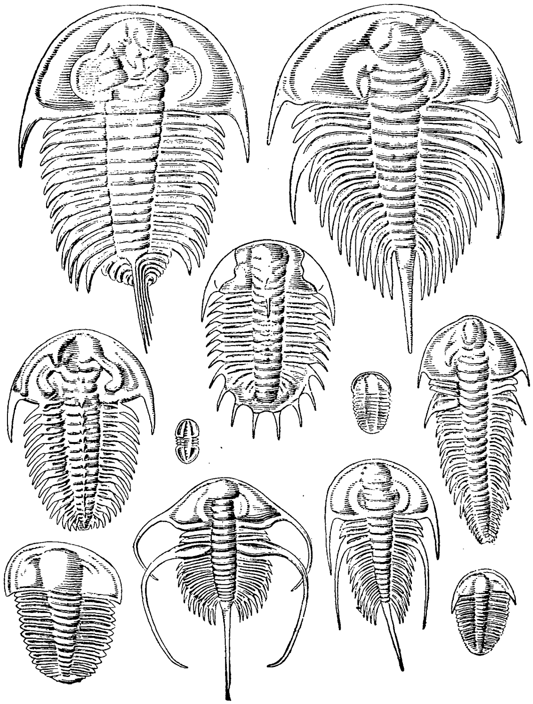

Fig. 12. A group of Lower Cambrian Trilobites (much reduced).

What these conditions were in other countries besides Europe and North America can not be stated, since the rocks in the more remote places have not been studied with the same care as in America and Europe. From the studies of Mr. C. D. Walcott and others, it seems clear that the continent of North America in Cambrian time had essentially the same outline it now has, although it was considerably less in extent. In brief, it has been ascertained that there was a depression along the margin of what is now the Appalachian chain from Newfoundland to Alabama, protected from the open sea, the primitive Atlantic, by a fringe of islands. Along the western slope of the site of the Rocky Mountain chain the same conditions prevailed, and in these two troughs the fauna lived and flourished. During Middle and Upper Cambrian time, conditions became modified so as to allow the fauna to exist in other localities, notably in Minnesota, Wisconsin and Texas.

Where the faunas originated, and how they spread from place to place, so as to become so widely scattered over the globe, are questions it is not, at present, possible to answer. That we know as much as we do about the life on the earth at so distant a period in its history, is owing to the patient work of a few enthusiastic students, among whom Mr. C. D. Walcott must always occupy a prominent position.

EDITOR'S TABLE.

—THE public is acquainted with the results of Peary's last expedition from which he has just returned. He was not able to discover his principal caches of food, and this, with the treachery of some of his Esquimaux, prevented him from reaching the coast which he discovered on his first expedition. He turned back in time to permit his reaching his camp of departure just as his provisions were exhausted. A heavy storm at the end might have ended his career at no great distance from his base of supplies. This season and the last were unfavorable for arctic exploration, and it is quite possible that some one may yet utilize Peary's supplies and reach higher latitudes in Greenland. It is, however, certain that Greenland does not lie in the most available route to the pole, which is by way of the islands north of Siberia. Science awaits with interest the results of Nansen's bold